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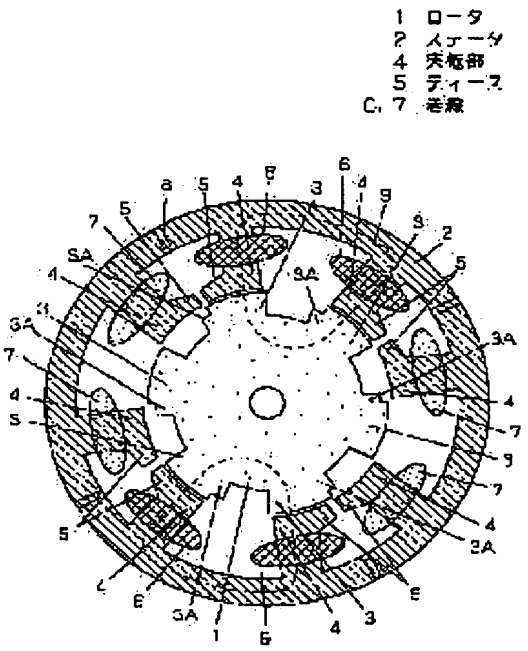
(54) SWITCHED RELUCTANCE MOTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a compact, low-cost, low-vibration, low-noise, and high- efficiency motor by solving the problem where the size of an entire device and a drive circuit is increased and noise and vibration are large in a switched reluctance motor.
SOLUTION: The switched reluctance motor consists of a rotor 1 with six protrusion poles 3, eight protrusion parts 4 that are provided at a stator 2, and teeth 5 that is provided so that the protrusion parts 4 in that coils with each separate phase being adjacent to bi-phase coils 6 and 7 are wound is in proximity, and the protrusion parts 4 in that adjacent coils in phase are wound are separated, thus reducing size, costs, vibration, and noise, and increasing efficiency.



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CLAIMS

[Claim(s)]
[Claim 1] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, said 2nd salient pole section around which said coil of an exception phase was coiled mutually approaches and adjoins [which has the coil of two phases wound around said 2nd salient pole section, and adjoins each other] each other -- the switch TORIRAKU wardrobe motor equipped with the teeth prepared so that said 2nd salient pole section around which said coil of an inphase was coiled mutually might be left.
[Claim 2] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, said 2nd salient pole section around which said coil of an exception phase was coiled mutually approaches and adjoins [which has the coil of two phases wound around said 2nd salient pole section, and adjoins each other] each other -- said 2nd salient pole section around which said coil of an inphase was coiled mutually with the teeth prepared so that it might separate The switch TORIRAKU wardrobe motor equipped with the auxiliary salient pole section prepared in the method opposite side of rotation of said 1st salient pole section of said Rota.
[Claim 3] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, said 2nd salient pole section around which said coil of an exception phase was coiled mutually approaches and adjoins [which adjoins the coil of two phases wound around said 2nd salient pole section] each other -- said 2nd salient pole section around which the coil of an inphase was coiled mutually with the teeth prepared so that it might separate The switch TORIRAKU wardrobe motor equipped with the magnetic obstruction formed in the slot section around which said coil of each other another phase which the periphery section of said stator adjoins was coiled.
[Claim 4] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, Said 2nd salient pole section around which the coil of two phases wound around said 2nd salient pole section and said coil of adjacent each-other another phase were coiled approaches. Said 2nd salient pole section around which said adjacent mutual coil in phase was coiled is the switch TORIRAKU wardrobe motor is equipped with the teeth prepared so that it might separate, and it enabled it to divide into 2n containing said 2nd salient pole section around which said coil in phase with said mutual stator was coiled.
[Claim 5] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, said 2nd salient pole section around which said coil of an exception phase was coiled mutually approaches and adjoins [which adjoins the coil of two phases wound around said 2nd salient pole section] each other -- said 2nd salient pole section around which said coil of an inphase was coiled mutually with the teeth prepared so that it might separate The switch TORIRAKU wardrobe motor equipped with a rotation location detection means to detect the rotation location of said Rota, and at least two switching elements which energize said coil according to the rotation location detected by said rotation location detection means.
[Claim 6] Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, said 2nd salient pole section around which said coil of an exception phase was coiled mutually approaches and adjoins [which adjoins the coil of two phases wound around said 2nd salient pole section] each other -- said 2nd salient pole section around which said coil of an inphase was coiled mutually with the teeth prepared so that it might separate The switch TORIRAKU wardrobe motor equipped with at least two switching elements which energize said coil, and the control circuit which energizes said switching element compulsorily during 1 scheduled time at the time of starting, and started starting from other switching elements after the completion of energization.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the switch TORIRAKU wardrobe motor used for the compressors of a refrigeration system.
[0002]
[Description of the Prior Art] Although there was a switch TORIRAKU wardrobe motor as a principle for many years, it is one of the motors improved with the advance of power electronics in recent years.
[0003] The top where structure is easy, since a switch TORIRAKU wardrobe motor says that it is strong and cheap, its motion applied as a brushless motor in recent years is active.
[0004] As such a conventional switch TORIRAKU wardrobe motor, it is as being shown, for example in JP,9-121590,A.
[0005] Hereafter, the conventional switch TORIRAKU wardrobe motor is explained using drawing 8 . Drawing 8 shows the circuit diagram of the conventional switch TORIRAKU wardrobe motor.
[0006] In drawing 8 , 100 is a switch TORIRAKU wardrobe motor. This switch TORIRAKU wardrobe motor 100 consists of a stator 101 with six salient poles, and Rota 102 with four salient poles.
[0007] Stator windings 103A, 103B, and 103C are respectively coiled around two salient pole parts which a stator 101 faces. Since each stator windings 103A, 103B, and 103C have been independent, the outgoing line of the power from the switch TORIRAKU wardrobe motor 100 has become a total of six.
[0008] A switching device 104 is connected between the positive supply of DC power supply (not shown), and the terminal of stator-winding 103A, while will stator-winding 103A Accept a switching device 105 with the negative supply of DC power supply, and it is connected between terminals.
[0009] Moreover, a switching device 106 is connected between the positive supply of DC power supply, and the terminal of stator-winding 103B, while will stator-winding 103B Accept a switching device 107 with the negative supply of DC power supply, and it is connected between terminals.
[0010] Moreover, a switching device 108 is connected between the positive supply of DC power supply, and the terminal of stator-winding 103C, and the switching device 109 is connected between the negative electrical potential difference of DC power supply, and another terminal of stator-winding 103C.
[0011] Moreover, in order to collect the energy from the magnetic circuit of a motor, diodes 110-115 are formed. Diode 110,111,112 is respectively connected by using the negative supply side of DC power supply as an anode between each switching device 104,106,108 and stator windings 103A, 103B, and 103C.
[0012] Moreover, diode 113,114,115 is respectively connected by using the positive supply side of DC power supply as a cathode between each switching device 105,107,109 and stator windings 103A, 103B, and 103C.
[0013] Next, the actuation is explained about the conventional switch TORIRAKU wardrobe motor constituted in this way.
[0014] If a switching device 104 and a switching device 105 are turned ON when Rota 102 is located in the location illustrated to drawing 8 , coil 103A will be excited. Then, reluctance torque is generated so that it may be easy to pass along magnetic flux and it may become, namely, so that the direction where the salient pole section of a stator 101 and the salient pole section of Rota 102 face each other may be turned to. That is, Rota 102 is rotated counterclockwise.
[0015] Before both salient pole faces each other completely, by turning off a switching device 104 and a switching device 105, the energy stored in stator-winding 103A is collected to a power-source side through diode 110 and diode 113.
[0016] Rota 102 will continue rotating by repeating exciting stator-winding 103B and stator-winding 103C

for this actuation one by one according to the location of the salient pole section of Rota 102.
[0017]
[Problem(s) to be Solved by the Invention] However, with the above-mentioned configuration, it had the technical problem that six switching devices were required for six pieces and diode, and a drive circuit will be enlarged. For example, when it carries in compressors, such as a refrigerator, and this power control unit is enlarged, the technical problem that the content volume of a refrigerator decreases occurs. Moreover, since the whole power control unit was enlarged, many man days for an assembly started and had the technical problem that cost cost dearly.
[0018] Moreover, six outgoing lines of stator winding are required, and serve as a twice as many number as this compared with 2 phase induction motor (three outgoing lines) currently used for the common compressor from the former, a three-phase-circuit induction motor, and a three-phase-circuit brushless motor (they are three outgoing lines by the star). It is difficult to pull out many lines from a well-closed container like especially a compressor, and the compressor itself was enlarged, and the man day increased, and it had the technical problem that cost was also attached highly.
[0019] Moreover, since the generating direction of torque turned into the direction of a vertical angle, distortion generated in a stator or Rota caused a big vibration and noise, and also had vibration and the technical problem that the noise was very high.
[0020] In order to carry out reduction of the number of switching devices, and reduction of the number of outgoing lines among these technical problems, although the approach of generally using as the motor of two phase windings is learned well, the torque ripple has the technical problem that become large and vibration and the noise become still larger. Moreover, the motor of two phase windings has possibility of carrying out inverse rotation, and when it is a compressor, man days, such as addition of the protective device of inverse rotation, will increase and carry out the cost rise of it.
[0021] By reducing the components mark of a drive circuit sharply and making the outgoing line from a motor into a number equivalent to the former further, this invention also aims vibration and the noise at offering the switch TORIRAKU wardrobe motor which can be reduced sharply while it attains a miniaturization and can also attain low cost-ization to coincidence.
[0022]
[Means for Solving the Problem] In order to solve this technical problem, this invention proposes a switch TORIRAKU wardrobe motor with new structure.
[0023] the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [which adjoins Rota with the 3n (n is the natural number) 1st salient pole section, a stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section] each other -- the 2nd salient pole section around which the coil of an inphase was coiled mutually consists of teeth prepared so that it might separate.
[0024] Thereby, though it is a switch TORIRAKU wardrobe motor with two phase windings, a torque ripple is small and vibration and the noise can decrease sharply compared with the former.
[0025] Moreover, the auxiliary salient pole section prepared in the hand of cut of the 1st salient pole section of Rota is prepared.
[0026] The inversion which may take place by two phase windings can be prevented by this, since consideration of an inversion becomes unnecessary, a man day can reduce, and cost can be lowered.
[0027] Moreover, it has the magnetic obstruction formed in the slot section around which the coil of each other another phase with which the periphery section of a stator adjoins each other was coiled.
[0028] Thereby, the leakage flux of a stator decreases, and since the amount of magnetic flux which can generate torque increases, the effectiveness of a motor can be raised.
[0029] Moreover, it enables it to divide a stator into 2n containing the 2nd salient pole section around which the mutual coil in phase was coiled.
[0030] While being able to coil stator winding very easily and reducing a man day sharply by this, the line moment of a slot can be gathered and the effectiveness of a motor can be gathered.
[0031] Moreover, it has a rotation location detection means to detect the rotation location of Rota, and at least two switching elements which energize a coil according to the rotation location detected by the rotation location detection means.
[0032] By this, switching elements can be reduced sharply, and a drive circuit can be miniaturized, and cost can also be reduced sharply.
[0033] Moreover, said switching element is compulsorily energized during 1 scheduled time at the time of starting, and it has the control circuit which started starting from other switching elements after the

completion of energization.
[0034] Thereby, since Rota is fixable to a predetermined location at the time of starting, it can be made to start certainly.
[0035]
[Embodiment of the Invention] Rota in which invention of this invention according to claim 1 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, The 2nd salient pole section around which the coil of an inphase was coiled mutually considers as the switch TORIRAKU wardrobe motor which consists of teeth prepared so that it might separate. the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [adjacent] each other -- Though it is two phase windings, while change of a RITAKU wardrobe becomes continuous and a torque ripple becomes small, the torque generating direction is set to 2n (n is the natural number), and it has the operation which can be distributed.
[0036] Rota in which invention according to claim 2 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [adjacent] each other -- the 2nd salient pole section around which the coil of an inphase was coiled mutually with the teeth prepared so that it might separate It considers as the switch TORIRAKU wardrobe motor equipped with the auxiliary salient pole section prepared in the method opposite side of rotation of the 1st salient pole section of Rota, and has an operation that reluctance can be made to produce imbalance by the auxiliary salient pole section.
[0037] Rota in which invention according to claim 3 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [which said stator has the 4n 2nd salient pole section, and adjoins each other] each other -- the 2nd salient pole section around which the coil of an inphase was coiled mutually with the teeth prepared so that it might separate When **** is excited by considering as the switch TORIRAKU wardrobe motor equipped with the magnetic obstruction formed in the slot section around which the coil of each other another phase with which the periphery section of said stator adjoins each other was coiled, it has an operation that the magnetic disclosure to other phases can be prevented.
[0038] Rota in which invention according to claim 4 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, The 2nd salient pole section around which the coil of an inphase was coiled mutually is equipped with the teeth prepared so that it might separate. the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [adjacent] each other -- By considering as the switch TORIRAKU wardrobe motor it enabled it to divide into 2n containing the 2nd salient pole section around which the mutual coil in phase was coiled, said stator has an operation that a coil can be carried out to the stator core beforehand divided at the time of assembly.
[0039] Rota in which invention according to claim 5 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [adjacent] each other -- the 2nd salient pole section around which the coil of an inphase was coiled mutually with the teeth prepared so that it might separate By considering as the switch TORIRAKU wardrobe motor equipped with a rotation location detection means to detect the rotation location of Rota, and at least two switching elements which energize a coil according to a rotation location It has an operation that a motor can be rotated by at least two switching elements.
[0040] Rota in which invention according to claim 6 has the 3n (n is the natural number) 1st salient pole section, A stator, the 4n 2nd salient pole section prepared in said stator, and the coil of two phases wound around said 2nd salient pole section, the 2nd salient pole section around which the coil of an exception phase was coiled mutually approaches and adjoins [adjacent] each other -- the 2nd salient pole section around which the coil of an inphase was coiled mutually with the teeth prepared so that it might separate Said switching element is compulsorily energized during 1 scheduled time at at least two switching elements which energize a coil, and the time of starting. By considering as the switch TORIRAKU wardrobe motor equipped with the control circuit which started starting from other switching elements after the completion of energization, Rota is rotated to a predetermined location at the time of starting, and it has an operation that always stabilized starting can be carried out.

[0041] Hereafter, the gestalt of operation of this invention is explained using drawing 5 from drawing 1 .
[0042] (Gestalt 1 of operation) Drawing 1 is the sectional view of the switch TORIRAKU wardrobe motor of the gestalt 1 of operation of this invention.
[0043] In drawing 1 , 1 is Rota and 2 is a stator.
[0044] Rota 1 has the six salient pole sections 3 (the 1st salient pole section) at equal intervals mostly. That is, a configuration like a gearing with six crests is carried out. Moreover, each crest and trough serve as regular intervals mostly. Moreover, in order to make Rota 1 generate the imbalance of reluctance, auxiliary salient pole section 3A is prepared in the hand of cut of the six salient pole sections 3. In the case of drawing 1 , a hand of cut is the direction of counterclockwise.
[0045] In a stator 2, it has the eight salient pole sections 4 (the 2nd salient pole section). Since the salient pole section 4 of the side which has teeth 5 in each salient pole section respectively, has teeth 5 only in one side of the salient pole section 4, and has teeth 5 is giving teeth similarly, each other salient pole section 4 will adjoin. On the other hand, since there is no salient pole section 4 of five teeth of the side which does not have the teeth 5 of the salient pole section 4, each other salient pole section 4 is separated from it.
[0046] That is, in this structure having the salient pole section 4 by turns, there is nothing, there is the salient pole section 4 continuously by two regular intervals mostly, and the section which anything does not have will exist at this spacing mostly with salient pole spacing for one after that.
[0047] 6 is the coil of an A phase and 7 is the coil of a B phase. It is wound around the eight salient pole sections 4 by the concentrated winding. moreover -- the coils 6 and 7 of phase with the another salient pole section 4 which is close in ****** mutually are coiled, and the coils 6 and 7 of the phase with the same salient pole section 4 from which one side adjoined each other and it is separated are coiled.
[0048] 8 is a magnetic obstruction and is prepared in the part of the slot around which the coils 6 and 7 of each other another phase which adjoins each other on the periphery of a stator 2 were coiled. Here, the magnetic obstruction by the air space is realized by only making a hole.
[0049] About the switch TORIRAKU wardrobe motor constituted as mentioned above, actuation is explained using drawing 1 .
[0050] Suppose that the coil 6 of an A phase is excited in drawing 1 . A magnetic path turns into a magnetic path as shown in 9 first. Now, Rota 1 is located in the location along which magnetic flux tends to pass to a magnetic path, and the coil inductance serves as maximum.
[0051] Next, excitation of the coil 6 of an A phase is stopped, and where the magnetic energy is lost completely, the coil 7 of a B phase is excited shortly. A magnetic path occurs in the salient pole section 4 which adjoined each other like the case of an A phase, and was moreover left. However, in the illustrated location, since a magnetic path is imperfect, reluctance torque generates it in the direction which forms a magnetic path. At this time, Rota 1 will be counterclockwise rotated according to the effectiveness of the imbalance by auxiliary salient pole section 3A prepared in Rota 1.
[0052] Rota 1 will continue rotation by repeating this actuation. It will not be excited to the location illustrated since the energy accumulated even if it cut excitation in fact was not immediately emitted, and excitation will be intercepted before that.
[0053] Since generating of the torque in this motor is performed in the four salient pole sections 4 among six places, the force is distributed, and the distortion of that part stator 2 and Rota 1 becomes small, and can reduce vibration and the noise. Moreover, since the use effectiveness of the salient pole section 4 is high, a motor efficiency also becomes high.
[0054] Since the magnetic path generated by excitation of the coil of each phase is generated in the salient pole section 4 which each other was adjoined and was moreover left, a magnetic path does not exist in the part of the magnetic obstruction 8 established on the periphery of a stator 2 and magnetic-flux leakage can be prevented with the magnetic obstruction 8, magnetic flux is effectively utilizable.
[0055] Next, the drive circuit of the switch TORIRAKU wardrobe motor of this invention is explained.
[0056] Drawing 2 is the circuit diagram of the drive circuit of the switch TORIRAKU wardrobe motor of the operation gestalt 1 of this invention.
[0057] In drawing 2 , 6 is an A phase coil, 7 is a B phase coil, and the coil of each four phases shown in drawing 1 is connected to a serial.
[0058] 10 is the DC power supply for motorised. For example, they are the DC power supply obtained by letting a rectifier circuit pass by considering a source power supply as an input.
[0059] 11 is the 1st switching element and uses IGBT (insulated-gate bipolar transistor) in this example. An emitter is connected to the negative terminal of DC power supply 10, and the collector is connected to the end of the A phase coil 6.

[0060] 12 is the 2nd switching element, an emitter is connected to the negative terminal of DC power supply 10, and the collector is connected to the end of the B phase coil 7.
[0061] 13 is the 3rd switching element, a collector is connected to the positive terminal of DC power supply 10, and the emitter is connected to the other end of the A phase coil 6 and the B phase coil 7.
[0062] The diode for collecting the energy from the magnetic circuit of a motor is connected to those with three piece, diode 14 is connected to the collector of the 1st switching element 11, and the positive terminal of DC power supply 10, and diode 15 is connected to the collector of the 1st switching element 12, and the positive terminal of DC power supply 10. Moreover, diode 16 is connected to the emitter of the 3rd switching element 13, and the negative terminal of DC power supply 10.
[0063] 17 is a rotation location detector (rotation location detection means) which detects the rotation location of Rota 1. The rotation location detector 17 may be presumed from the current wave form where it flows on a motor etc., although an encoder, a photo interrupter, etc. are generally used well.
[0064] 18 is a control circuit, makes the signal which excites a coil based on the position signal which is an output signal of the rotation location detector 17, and controls the 1st switching element 11, the 2nd switching element 12, and the 3rd switching element 13 according to the signal.
[0065] Thus, the actuation is explained using drawing 2 and drawing 3 about the constituted drive circuit.
[0066] Drawing 3 is a timing chart which shows actuation of the drive circuit of the gestalt 1 of operation of this invention. Drawing 3 shows the wave of the drive circuit under motor rotation of operation.
[0067] Drawing 3 (a) shows change of the inductance of the A phase coil 6 and the B phase coil 7. Change of the inductance of the A phase coil 6 is a continuous line, and a broken line shows change of the inductance of the B phase coil 7. When the salient pole section 4 by the side of a stator 2 and the salient pole section 3 of Rota 1 face, an inductance serves as max and the imbalance by auxiliary salient pole section 3A of Rota 1 is seen in the inductance minimum section.
[0068] Drawing 3 (b) is a position signal from the rotation location detector 17. Drawing 3 (c) is [the wave of the gate signal of the 2nd switching element 12 and drawing 3 (e) of the wave of the gate signal of the 1st switching element 11 and drawing 3 (d)] the waves of the gate signal of the 3rd switching element 13. Moreover, drawing 3 (f) shows the current wave form of the A phase coil 6, and drawing 3 (g) shows the current wave form of the B phase coil 7.
[0069] With rotation of Rota 1, as shown in drawing 3 (b), the position signal from the rotation location detector 17 changes. He is trying for a position signal to change here in the location where the salient pole section 3 of Rota 1 and the salient pole section 4 of a stator 2 face. In the case of the motor of the structure of drawing 1 , it becomes one rotation with the mechanical time of the position signal from the rotation location detecting signal 17 changing 12 times.
[0070] While the inductance of the A phase coil 6 is changing with the forward inclination, if the A phase coil 6 is excited, the running torque of the forward direction will occur. Therefore, after the position signal from the rotation location detector 17 detects the forward direction edge which changes from "LOW" to "HIGH", in order to excite the A phase coil 6, the 1st switching element 11 is made to turn on and a current is passed.
[0071] Moreover, in order to adjust an engine speed, the signal which makes the 1st switching element 11 turn on controls the current by carrying out PWM (Pulse Density Modulation) control to be shown in drawing 3 (f).
[0072] In the 1st switching element 11, even if off, a current is not immediately set to 0 with the inductance of the A phase coil 6. While the inductance of the A phase coil 6 is changing with the negative inclination, since the running torque of the negative direction will apply brakes to generating, i.e., rotation, when the A phase coil 6 excites, effectiveness will fall.
[0073] Therefore, by the time the position signal from the rotation location detector 17 detects the negative direction edge, in order to stop excitation for the A phase coil 6, it is made to make it decrease to the level which will set a current to 0 by the time it makes the 1st switching element 11 turn off and negative torque starts before predetermined time, or does not have almost effect.
[0074] The following actuation is performed by synchronizing the 3rd switching element 13 with the 1st switching element 11 here, making it synchronize with ON by carrying out, and turning OFF. However, the 3rd switching element 13 does not perform PWM control, as shown in drawing 3 (e). If the 1st switching element 11 and the 3rd switching element 13 are turned OFF in the condition that the current is flowing at coincidence, by collecting energy to DC power supply 10 through diode 14 and diode 16, the energy of the A phase coil 6 makes the rate to which a current decreases increase, and can shorten time amount.
[0075] The 2nd switching element 12 makes rotation continue according to change of the inductance of the

B phase coil 7 by making it operate in the same condition as the 1st switching element 11.
[0076] The 3rd switching element 13 synchronizes to the timing which the 2nd switching element 12 turns on, and is set to ON. namely, the time of ON or the 2nd switching element 12 turning [the 1st switching element 11] on the 3rd switching element 13 -- an PWM system -- it is made to turn on without putting in
[0077] Although three switching elements are used with the gestalt 1 of this operation, since the 3rd switching element 13 enlarges the inclination of the current at the time of making excitation of a coil turn off, it is also possible to reduce, since it changes with the value of an inductance etc. At this time, diodes 16 can also be reduced to coincidence.
[0078] Next, the actuation at the time of starting is explained using drawing 4 . Drawing 4 is the flow chart showing the actuation at the time of starting of the drive circuit of the gestalt 1 of operation of this invention.
[0079] An operation signal is inputted from a idle state by STEP1. When it stops last time, where Rota 1 has stopped and since it cannot decide, the location of Rota 1 is first moved to a predetermined location. Therefore, Rota 1 is brought to the A phase coil 6 by STEP2 in the location where the salient pole section 3 of Rota 1 and the salient pole section 4 of a stator 2 face by carrying out fixed time amount energization. The level (for example, duty of PWM control) of energization here is sufficient level to move Rota 1, and fixed time amount says the time amount in which the rotational vibration of Rota 1 after migration is fully settled.
[0080] Next, Rota 1 starts energization to the B phase coil 7 by STEP3 after migration to a predetermined location. Then, rotation starts in the predetermined direction (it sets in the gestalt 1 of this operation, and is the direction of a counterclockwise rotation) according to the imbalance of the inductance by auxiliary salient pole section 3A. Since Rota 1 is moved to the predetermined location by STEP2, a hand of cut is determined by auxiliary salient pole section 3A of Rota 1, and it can move from it to rotation action normally, without reversing.
[0081] Next, it changes to the commutation by the position signal from the rotation location detector 17 by STEP4, and rotation is made to continue. Applied voltage is raised by STEP5 (the duty width of face of PWM control is gone up), and the rotational frequency is made to increase.
[0082] If it reaches to a target rotational frequency, the rise of applied voltage will be stopped by STEP6, and it will go into revolving speed control by STEP7. Here, applied-voltage elongation adjustment is performed, looking at a rotational frequency.
[0083] The power control unit of the refrigeration system of the gestalt 1 of operation of this invention has the following effectiveness as explained above.
[0084] Rota 1 with the six salient pole sections 3, a stator 2, and the eight salient pole sections 4 prepared in the stator 2, The salient pole section 4 around which the coils 6 and 7 of two phases wound around the salient pole section 4 and the coils 6 and 7 of adjacent each-other another phase were coiled approaches. The salient pole section 4 around which the adjacent mutual coils 6 and 7 in phase were coiled considers as the switch TORIRAKU wardrobe motor which consists of teeth 5 prepared so that it might separate. Though it is two phase windings 6 and 7, while change of a RITAKU wardrobe becomes continuous and a torque ripple becomes small, the torque generating direction turns into four directions, and since it can distribute, it has the effectiveness that the noise and vibration become very small.
[0085] Moreover, since reluctance can be made to produce imbalance by auxiliary salient pole section 3A, an inversion is lost by preparing auxiliary salient pole section 3A prepared in the method opposite side of rotation of the salient pole section 3 of Rota 1 and the consideration to inverse rotation becomes unnecessary, the miniaturization of the compressor carrying this motor is possible, and it serves as low cost.
[0086] Since the magnetic disclosure to other phases can be prevented when **** is excited by having the magnetic obstruction 8 formed in the slot section around which the coils 6 and 7 of each other another phase with which the periphery section of a stator 2 adjoins each other were coiled, the effectiveness of a motor improves.
[0087] Since it can be made to rotate by at least two switching elements 11 and 12 by having the rotation location detector 17 which detects the rotation location of Rota, and two switching elements 11 and 12 which energize coils 6 and 7 according to a rotation location, a drive circuit is miniaturized, and moreover, a man day can reduce sharply and can also reduce cost sharply. Moreover, a man day is reducible while being able to prevent enlargement of a compressor, since the outgoing line from a motor also becomes three and can construct a compressor using a terminal equivalent to the former.
[0088] By energizing said switching element compulsorily during 1 scheduled time at the time of starting, and considering as the switch TORIRAKU wardrobe motor equipped with the control circuit which started

starting from other switching elements after the completion of energization, at the time of starting, Rota can be rotated to a predetermined location and always stabilized starting can be carried out.
[0089] In the explanation in the gestalt 1 of operation, although switching elements 11, 12, and 13 were set to IGBT, they are completely satisfactory at other natural switching elements.
[0090] Moreover, although coils 6 and 7 were formed in the salient pole section 4, as long as it is the part which can constitute the same magnetic path, you may wind around other parts (for example, periphery section of a stator 2 etc.).
[0091] (Gestalt 2 of operation) Drawing 5 is the front view of the division core of the switch TORIRAKU wardrobe motor of the gestalt 2 of operation of this invention. Drawing 5 quadrisects a core at the time of the assembly of the switch TORIRAKU wardrobe motor shown in drawing 1 .
[0092] In drawing 5 , 20 shows a part of division core which quadrisected the stator 2. 21 is the salient pole section (the 2nd salient pole section) of a stator 2, and 22 is teeth. Division divides as a lot the pair of the part which the adjacent salient pole section 21 left.
[0093] 23 is a coil and is wound around the salient pole section 21. The heights 24 and the crevice 25 in which ******** is possible mutually are established in the end face of the division core 20.
[0094] the adjacent salient pole section 21 -- mutual -- next door **** -- if a coil is coiled around the slot of the part in which teeth 22 were formed like, the distance between each other teeth 22 will become it is very short and difficult [a coil], and also the line moment will fall, and effectiveness will fall. Moreover, if between teeth 22 is extended so that a coil can be done, balance with the salient pole section 3 (the 1st salient pole section) of Rota 1 will collapse, and it becomes the factor to which effectiveness similarly falls.
[0095] then, by dividing a core, as shown in drawing 5 , workability is boiled markedly and improves. since [namely,] there is between [no] the adjoining teeth 22 which a coil 23 cannot roll easily -- a coil 23 -- very much -- carrying out -- easy -- the line moment -- large -- improving -- in addition -- and since teeth 22 adjoining spacing can fully put, it is good, and balance with the salient pole section 3 of Rota 1 also boils effectiveness markedly, and improves.
[0096] Moreover, although it assembles by inserting in by heights 24 and the crevice 25 and carrying out **** when assembling four divided division cores 20, since it is the part along which a magnetic path originally does not pass, there is no effect in effectiveness, and a mechanical strength should just only have this connection part.
[0097] The switch TORIRAKU wardrobe motor of the gestalt 2 of operation of this invention has the following effectiveness as explained above.
[0098] It can reduce the man day at the time of assembly sharply while its effectiveness can improve remarkably according to the effectiveness of the line moment improving, since a stator 2 can carry out a coil 23 to the stator core beforehand divided at the time of assembly by considering as the switch TORIRAKU wardrobe motor it enabled it to divide into four containing the salient pole section 21 around which the mutual coil 23 in phase was coiled.
[0099] As mentioned above, in the gestalt of this operation, although the salient pole section 3 of Rota 1 explained six switch TORIRAKU wardrobe motors, it explains that other configurations are the same. About the drive approach, it is completely the same. However, it cannot be overemphasized that only the relation between the count of a switch and a rotational frequency changes.
[0100] (Gestalt 3 of operation) The salient pole section of drawing 6 of Rota of this invention is structural drawing of three switch TORIRAKU wardrobe motors.
[0101] 30 is Rota. Rota 30 has three salient pole sections 30A (the 1st salient pole section) at equal intervals mostly. That is, a configuration like a gearing with three crests is carried out. Moreover, each crest and trough serve as regular intervals mostly. Auxiliary salient pole section 3A is the same as that of drawing 1 , and explanation is omitted.
[0102] 31 is a stator. A stator 31 has four salient pole sections 31A (the 2nd salient pole section). Since salient pole section 31A of the side which has teeth 31B in each salient pole section 31A respectively, has teeth 31B only in one side of salient pole section 31A, and has teeth 31B is giving teeth 31B similarly, each other salient pole section 31A will adjoin. On the other hand, in order that salient pole section 31A of the side which does not have teeth 31B of salient pole section 31A may not have teeth 31B, each other salient pole section 31A is separated.
[0103] Since it is the same as drawing 1 , actuation is omitted.
[0104] (Gestalt 4 of operation) The salient pole section of drawing 7 of Rota of this invention is structural drawing of nine switch TORIRAKU wardrobe motors.
[0105] 40 is Rota. Rota 40 has nine salient pole sections 40A (the 1st salient pole section) at equal intervals

mostly. That is, a configuration like a gearing with nine crests is carried out. Moreover, each crest and trough serve as regular intervals mostly. Auxiliary salient pole section 3A is the same as that of drawing 1 , and explanation is omitted.

[0106] 41 is a stator. A stator 41 has 12 salient pole sections 41A (the 2nd salient pole section). Since the salient pole section of the side which has teeth 41B in each salient pole section 41A respectively, has teeth 41B only in one side of salient pole section 41A, and has teeth 41B is giving teeth 41B similarly, each other salient pole section 41A will adjoin. On the other hand, in order that salient pole section 41A of the side which does not have teeth 41B of salient pole section 41A may not have teeth 41B, each other salient pole section 41A is separated.

[0107] Since it is the same as drawing 1 , actuation is omitted.

[0108] Similarly salient pole section 40A of Rota 40 cannot constitute about a 3n (n is the natural number) thing as mentioned above also until it says.

[0109]

[Effect of the Invention] As mentioned above, the switch TORIRAKU wardrobe motor of this invention Rota with the 3n (n is the natural number) 1st salient pole section, a stator, and the 4n 2nd salient pole section prepared in said stator, The 2nd salient pole section around which the coil of two phases wound around said 2nd salient pole section and the coil of adjacent each-other another phase were coiled approaches. The 2nd salient pole section around which the adjacent mutual coil in phase was coiled considers as the switch TORIRAKU wardrobe motor which consists of teeth prepared so that it might separate. Though it is two phase windings, while change of a RITAKU wardrobe becomes continuous and a torque ripple becomes small, the torque generating direction is set to 2n (n is the natural number), and since it can distribute, it has the effectiveness that the noise and vibration become very small.

[0110] Moreover, since it can consider as the switch TORIRAKU wardrobe motor equipped with the auxiliary salient pole section prepared in the method opposite side of rotation of the salient pole section of Rota, reluctance can be made to produce imbalance by the auxiliary salient pole section, an inversion is lost and the consideration to inverse rotation becomes unnecessary, the miniaturization of the compressor carrying this motor is possible, and it serves as low cost.

[0111] Moreover, since the magnetic disclosure to other phases can be prevented when **** is excited by considering as the switch TORIRAKU wardrobe motor equipped with the magnetic obstruction formed in the slot section around which the coil of each other another phase with which the periphery section of said stator adjoins each other was coiled, the effectiveness of a motor improves.

[0112] Moreover, it can reduce the man day at the time of assembly sharply while its effectiveness can improve remarkably according to the effectiveness of the line moment improving, since said stator can carry out a coil to the stator core beforehand divided at the time of assembly by considering as the switch TORIRAKU wardrobe motor it enabled it to divide into 2n containing the salient pole section around which the mutual coil in phase was coiled.

[0113] Moreover, since a motor can be rotated by at least two switching elements by considering as the switch TORIRAKU wardrobe motor equipped with a rotation location detection means to detect the rotation location of Rota, and at least two switching elements which energize a coil according to a rotation location, a drive circuit is miniaturized, and a man day can reduce sharply and can also reduce cost sharply. Moreover, a man day is reducible while being able to prevent enlargement of a compressor, since the outgoing line from a motor also becomes three and can construct a compressor using a terminal equivalent to the former.

[0114] Moreover, by considering as the switch TORIRAKU wardrobe motor equipped with at least two switching elements which energize a coil, and the control circuit which energizes said switching element compulsorily during 1 scheduled time at the time of starting, and started starting from other switching elements after the completion of energization, at the time of starting, Rota can be rotated to a predetermined location and always stabilized starting can be carried out.

[Translation done.]

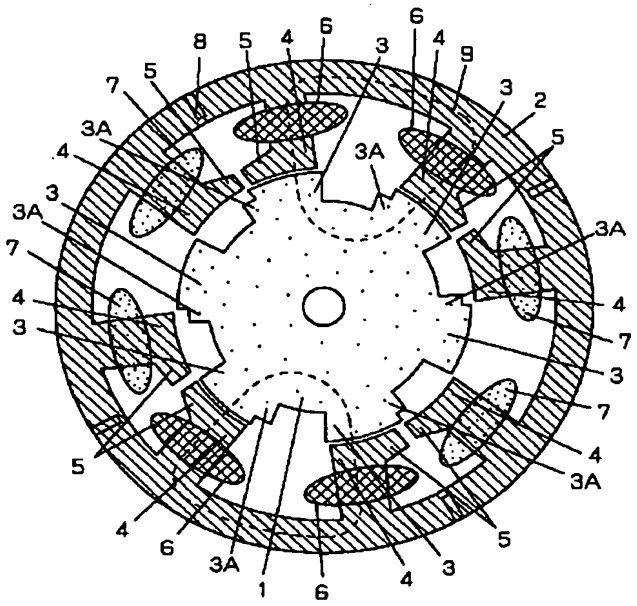
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

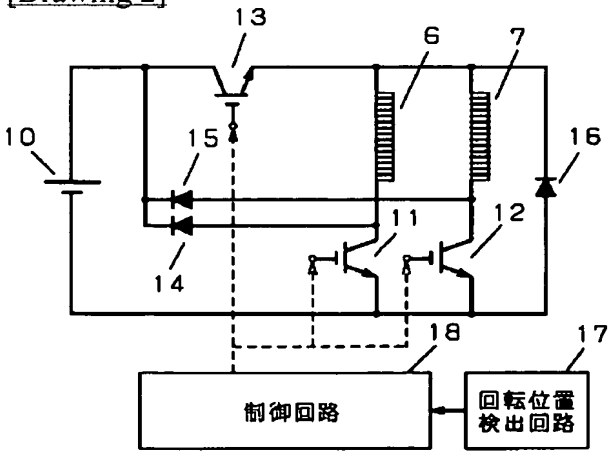
DRAWINGS

[Drawing 1]

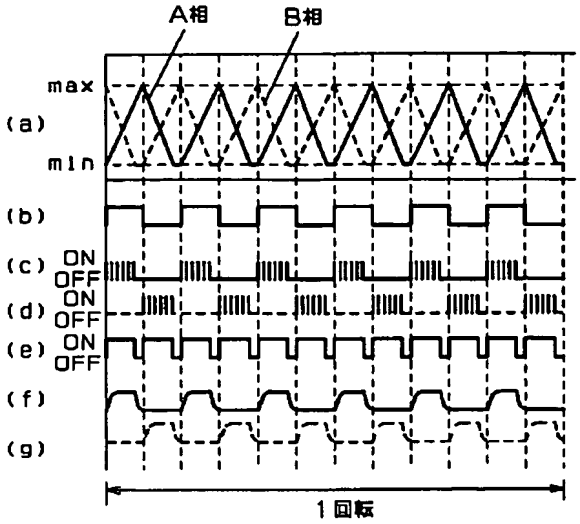
1 ロータ
2 ステータ
4 突極部
5 ティース
6, 7 巻線



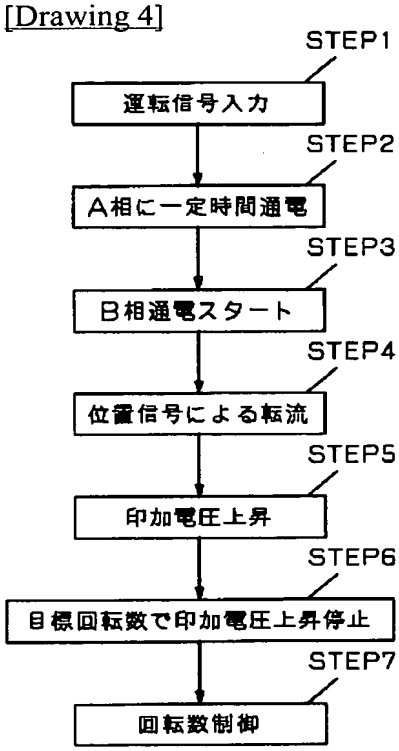
[Drawing 2]



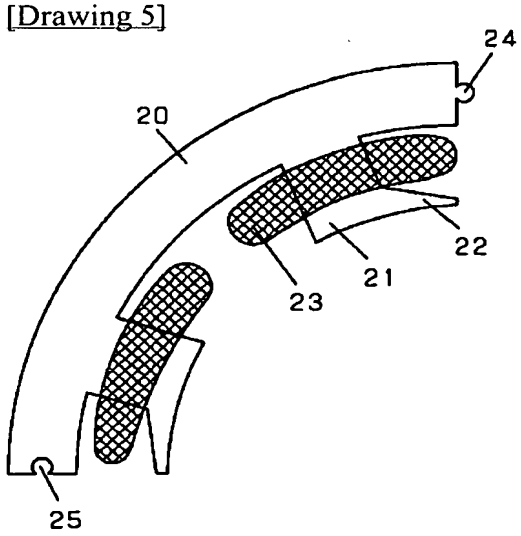
[Drawing 3]



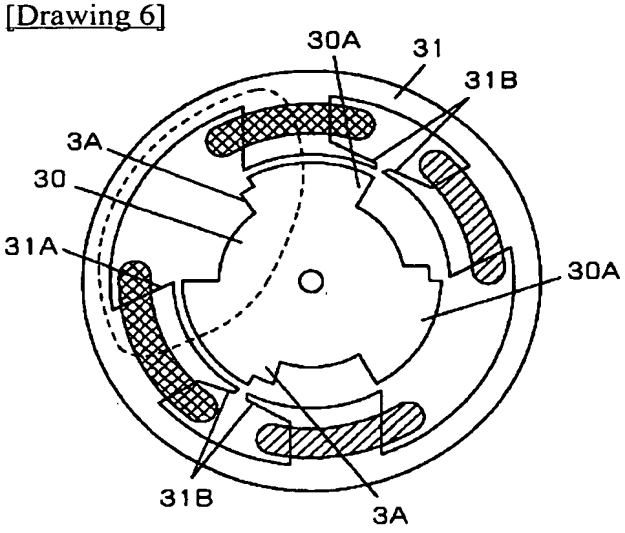
[Drawing 4]



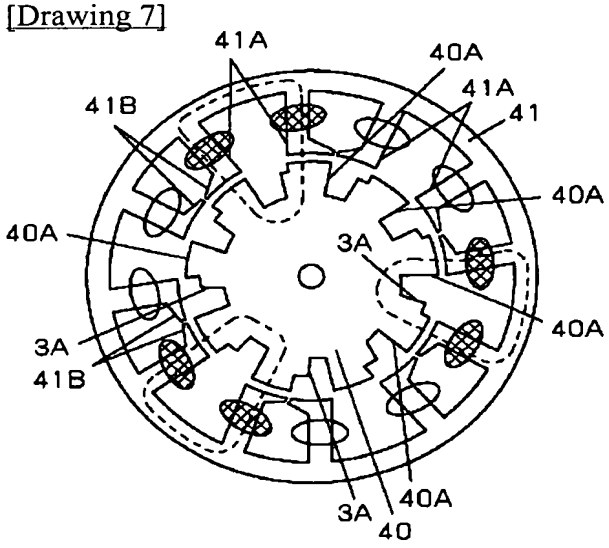
[Drawing 5]



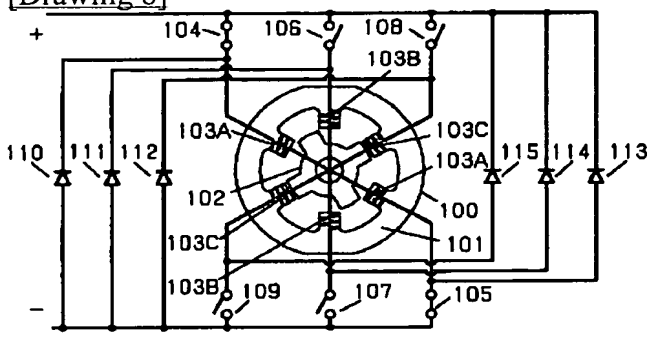
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]